Enabling the Smart Grid with Cutting Edge Electrical Load Measurement

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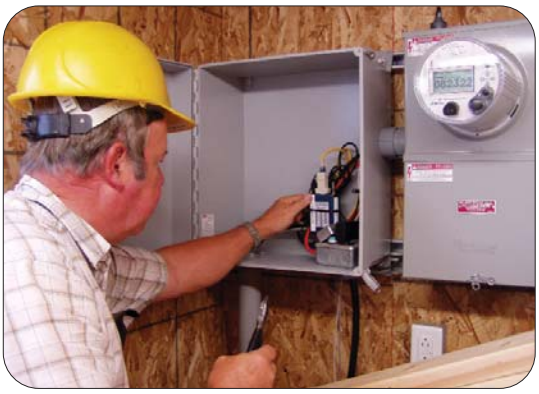
The concept of the Smart Grid relies on the dynamic management of supply and demand resources through a combination of data, communications and controls. This level of automation allows for real-time operational optimization of the grid, which affects everything from energy economics and emissions to security and reliability.

Demand response, the policy in which energy customers reduce or modify their usage in response to price signals or other types of programs and incentives, is a primary component of Smart Grid strategy. To make the grid "smarter", customer loads and other usage information must be fully and dynamically integrated into the operation of the grid. This requirement lays focus on the technologies that enable demand response, such as smart meters, communication and control systems, storage systems and other demand control technologies.



Government Support Helps Smart Meters Gain Momentum

In recent years the push toward Smart Grid technology has been fueled by federal mandates, stimulus and on-going standardization efforts. In addition to establishing nationwide renewable fuel standards, the 2005 Domenici-Barton Act also mandates the exploration of smart metering options. This exploration was provided financial backing by the Recovery Act, in which the Department of Energy announced distribution of $3.3 billion in stimulus funds for Smart Grid technology development grants. That amount has since increased and is complemented by an additional $615 million for regional demonstration projects that exhibit Smart Grid storage, monitoring and technology viability.

According to a recent market research report (Residential Energy Management: Company, Alliance & Technology Profiles) released by Parks Associates, eight million smart meters, more than six percent of all US meters, have already been deployed in this country and the associated residential energy management market segment is almost guaranteed to sustain significant growth. Researchers at Parks Associates assert the deployment of so many meters is the first step toward deploying Smart Grid technologies and advanced meter infrastructure on a broad scale.

Factors Dictating Shift to Alternative Energy, Technology and Infrastructure

Concerns over climate change, heavy reliance on foreign oil and the dwindling quantities of resources have pushed the US government to implement programs based on conservation and development of alternative fuels and infrastructure. In addition, high energy costs and consumer demand for enhanced services have prompted providers to look closely at their automation strategy and look toward utilizing robust and intelligent technologies to improve operational efficiency. With the recent sunsetting of AMPs, many utility providers with existing automated metering applications are shifting to more standardized, accessible formats, such as Internet protocol-based data transmission.

Case Study: Advancing the Grid with Smart Metering

One such provider is Central Iowa Power Cooperative (CIPCO). CIPCO is a generation and transmission cooperative serving 12 rural electric cooperatives and a collection of municipal associations in the state of Iowa. CIPCO's service territory stretches 300 miles diagonally across the state, from the Mississippi River in the northeast to Shenandoah in the southwest. CIPCO's member distribution cooperatives deliver power to farmsteads, industrial parks, commercial businesses, urban residences and manufacturers. Working together, CIPCO and its member cooperatives provide electrical service to over 316,500 Iowans.

Originally motivated by the Rural Electrification Act of 1936, which provided low interest federal loans to suppliers willing to extend service into less densely populated areas, the customer-owned utility has spent the last 60 years building a solid cooperative business model for power distribution throughout Iowa.

CIPCO collects power measurements each month for both billing purposes and planning initiatives such as anticipating future power generation and equipment needs. These measurements were traditionally collected manually by staff members sent to substations, often in secluded areas, to read wholesale meters and collect load balance information being captured in 15 minute intervals on magnetic tape drives. The original monthly process required a fleet of trucks, experienced personnel working in high voltage environments and an inordinate amount of time was eventually supplanted by a process called probing. This was a similar method that required on-site use of a handheld analog phone device and optical cable to collect power measurements. Although it's been the industry standard over the last decade, probing remains a time-consuming, labor intensive and inefficient process, with each field technician only able to cover 12 to 14 metering points each month because of the large distances between points.

With the sunsetting of analog cellular networks, CIPCO was faced with a challenge. In order to continue collecting its measurements used for billing and planning it would need to upgrade its analog phone devices to digital communications equipment. The cooperative viewed the forced migration as an opportunity to employ greener, Smart Grid technologies and turned to GetWireless to help meet the challenge. After analyzing the current processes and new requirements, GetWireless collaborated with CIPCO to design a comprehensive solution that would exceed their expectations.

"We're not in this for the short term," said Don Chaon, manager of data systems for CIPCO, on why the company employed GetWireless to aid with the migration. "We needed someone who knows what they're doing."

Using an Intelligent Cellular Solution to Improve Service and Reduce Operating Expenses

CIPCO started by testing four digital wireless products as potential replacements for current analog devices. After almost four months of field usage, the results pointed to the AirLink Raven XT communications gateway from Sierra Wireless. Within the field testing environment developed by CIPCO, the intelligent cellular gateways provided reliable connectivity, fast data transfer speeds and remote management simplicity enabled by the gateway's suite of tools and utilities.

The Raven XT gateway provides CIPCO with the remote monitoring and two-way communication required for unmanned applications. Unlike the probing process that requires travel to each metering site, the rugged wireless gateway allows remote data collection and features a Class I Div 2 certification for use in hazardous conditions such as those found in substation environments and its compact form factor enables integration within existing infrastructure and enclosures.

Powered by ALEOS core embedded intelligence, the Raven XT provides always-on connectivity that gives CIPCO access to its data at all times. ACEware tools and utilities provide remote management, configuration and troubleshooting capabilities, enabling CIPCO to monitor and control its network of wireless gateways 24/7 and from one central location or from anywhere with an Internet connection. ACEware, coupled with ALEOS, ultimately lowers total cost of ownership by virtually eliminating the need for field service to CIPCO's rural substations.

"We figured that it cost at least $30, every time, to collect a single meter reading before, but now our only cost is the $10 monthly charge for our cellular service,' said Chaon. "The digital cellular solution has also increased the safety for our field staff, who are no longer required to travel to and enter high voltage substations to read meters."

The $30 meter read includes labor, vehicle, primary retrieval (meter to handheld at the substation), equipment (handheld, modem, misc.) and secondary retrieval (handheld to computer at the distribution coop office). This cost reflects a single meter read, whereas the digital cellular solution provides CIPCO with frequent access to meter data throughout the month.

CIPCO relied heavily on GetWireless to be part of its solution deployment team, providing Raven XT setup and configuration, provisioning and training. As part of the value-added service provided by GetWireless, they also helped CIPCO investigate the best network provider option for the solution and handled the activation process in its entirety, including account setup, plan selection and contract completion.

"Getting the new solution deployed was a team effort," said Chaon. "It required research, learning about the new environment, new connections, new installation procedures, new customer requirements."

By using the Raven XT for cellular transmission over the public network, many of CIPCO's cooperatives are able to avoid additional private network or landline charges, as well as the steep cost of running copper landlines into rural areas where they don't already exist. The cellular gateway allows CIPCO to create a "virtual rural infrastructure" for its meter information collection initiatives.

Currently, CIPCO has 106 Raven XT units at substations across Iowa and has been able to reduce the time necessary for remote interrogation of billing information to just half a day, down from seven days with magnetic tape or four days with handheld analog probing devices. The Raven XT devices currently account for a little over 50 percent of CIPCO's billing activity.

Successful Results Provide Lasting Benefits

The success of the Raven XT as a communication conduit for CIPCO's transmission and distribution environments has given the cooperative a new tool in electrical load measurement and balance. This resource has an enabling effect on billing, load research, capital planning and power quality. The continuous collection of detailed usage information using reliable two-way cellular communications equipment perfectly positions CIPCO to evolve its planning and load balance initiatives by enabling the cooperative to accurately predict future power consumption trends and create the generation programs needed to fulfill and/or control consumption levels.

"Before we started deploying, the solution was new and strange. You can see now that the tension has gone away and people can see that this solution is working well," said Chaon. "Given our current success, we will have no second thoughts about deploying additional cellular units at new wholesale delivery points or for end-use studies, either commercial or residential."

The increasing demand on utilities requires improvements in efficiency, cost savings and conservation of energy distribution. CIPCO is just one example of how an intelligent, digital cellular solution can increase efficiencies in the meter interrogation process, which in turn improves related processes throughout the organization. This upgrade to smart metering technology not only improved the utility's overall processes by increasing efficiency and improving customer service, it also reduced the TCO of its metering solution while providing time savings benefits through remote, real-time monitoring and collection of critical data. To be successful, utilities must embrace the challenge, and opportunity, to upgrade their processes and begin investing in Smart Grid technologies that will result in improved demand response policies, as well as lasting monetary and environmental benefits.